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ENVIRONMENTAL RESEARCH BRIEF

Waste Minimization Assessment for a Manufacturer of Paints and Lacquers

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Abstract

The U.S. Environmental Protection Agency (EPA) has funded a pilot project to assist small and medium-size manufacturers who want to minimize their generation of waste but who lack the expertise to do so. In an effort to assist these manufacturers Waste Minimization Assessment Centers (WMACs) were established at selected universities, and procedures were adapted from the EPA *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003, July 1988). That document has been superseded by the *Facility Pollution Prevention Guide* (EPA/600/R-92/088, May 1992). The WMAC at the University of Tennessee performed an assessment for a plant that manufactures lacquers and paints. Raw materials, including additives and solvent or water, are blended at mixing stations. The resulting mixture may be ground in a sand-mill or a pebble-mill. Next, the mixture is pumped to the let-down tanks where additives, tints, resins, and solvent or water are added. After testing and any required adjustments, the product is packaged. The team's report, detailing findings and recommendations, indicated that waste solvent is the waste stream generated in the greatest quantity and that significant cost savings could be achieved by implementing a computer-based system for batch scheduling, inventory, and waste documentation.

This Research Brief was developed by the principal investigators and EPA's Risk Reduction Engineering Laboratory, Cincinnati, OH, to announce key findings of an ongoing research project that is fully documented in a separate report of the same title available from University City Science Center.

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Introduction

The amount of waste generated by industrial plants has become an increasingly costly problem for manufacturers and an additional stress on the environment. One solution to the problem of waste generation is to reduce or eliminate the waste at its source.

University City Science Center (Philadelphia, PA) has begun a pilot project to assist small and medium-size manufacturers who want to minimize their generation of waste but who lack the in-house expertise to do so. Under agreement with EPA's Risk Reduction Engineering Laboratory, the Science Center has established three WMACs. This assessment was done by engineering faculty and students at the University of Tennessee's (Knoxville) WMAC. The assessment teams have considerable direct experience with process operations in manufacturing plants and also have the knowledge and skills needed to minimize waste generation.

The waste minimization assessments are done for small and medium-size manufacturers at no out-of-pocket cost to the client. To qualify for the assessment, each client must fall within Standard Industrial Classification Code 20-39, have gross annual sales not exceeding $75 million, employ no more than 500 persons, and lack in-house expertise in waste minimization.

The potential benefits of the pilot project include minimization of the amount of waste generated by manufacturers and reduced waste treatment and disposal costs for participating plants. In addition, the project provides valuable experience for graduate and undergraduate students who participate in the program and a cleaner environment without more regulations and higher costs for manufacturers.

Methodology of Assessments

The waste minimization assessments require several site visits to each client served. In general, the WMACs follow the procedures outlined in the EPA *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003, July 1988). The WMAC staff locate the sources of waste in the plant and identify the current disposal or treatment methods and their associated costs. They then identify and analyze a variety of ways to reduce or eliminate the waste. Specific measures to achieve that goal are recommended and the essential supporting technological and economic information is developed. Finally, a confidential report that details the WMAC's findings and recommendations (including cost savings, implementation costs, and payback times) is prepared for each client.

Plant Background

This plant manufactures lacquers and consumer and industrial water-based and solvent-based paints. It operates 4,000 hr/yr to produce approximately 1.5 million gal of paint and lacquer annually.

Manufacturing Process

The raw materials used by this plant include pigments, resins, fillers, plasticizers, dryers, preservatives (for water-based paints), solvents, and water. Water-based paints represent about one-third of the total production; the remainder is solvent-based. The production processes for water-based and solvent-based products are very similar; the major distinction between the processes is the use of water or solvent.

Specified amounts of raw materials are prepared for batches of product in the pre-batch area. Those ingredients, other additives, and solvent or water are blended at one of several mixing stations. Pigment dispersion is checked and if it is unacceptable the mixture is ground in a sand-mill or a pebble-mill. If lacquer is being manufactured, the liquid from the mills is sent to a separate building where additives are incorporated and the resulting mixture is pumped into drums.

For products other than lacquers, the mixture is pumped from the mixing station or from the mills to one of several letdown tanks where additives, tint, resins, and solvent (or water) are added. The viscosity, dry gloss, translucency, color, and other physical properties of the product are tested in the laboratory and adjustments are made as needed. The product is pumped from the letdown tanks through filters to an automated filling unit or gravity-fed to drums and tankers.

An abbreviated process flow diagram is shown in Figure 1.

Existing Waste Management Practices

This plant already has implemented the following techniques to manage and minimize its wastes:

- When possible, cleaning solvents are reused in paint formulation.
- Plastic liners are used in steel pails to reduce cleaning wastes.
- Obsolete products and products returned by customers are blended into new products when feasible.

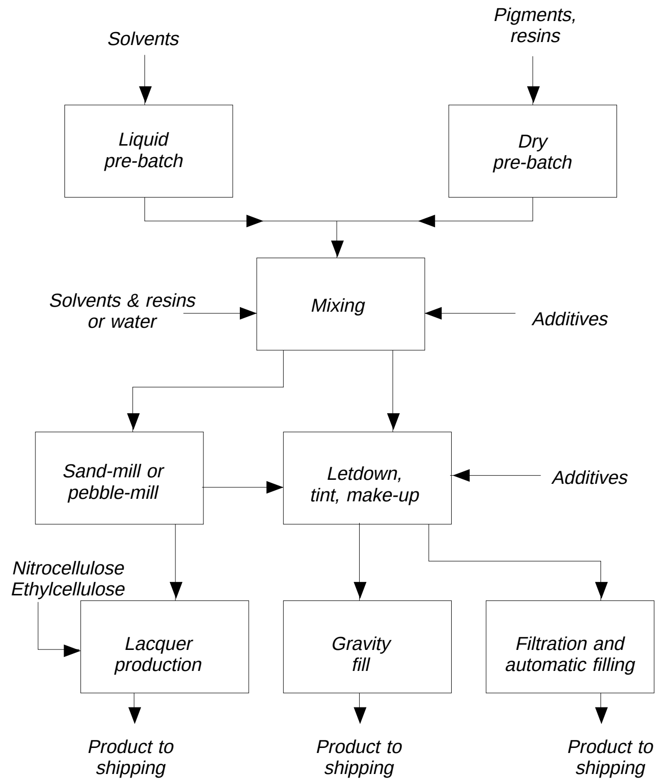

Figure 1. *Abbreviated process flow diagram.*

- Plant personnel are evaluating the possible purchase of a distillation unit for the recovery of spent solvents that are currently shipped off-site.

Waste Minimization Opportunities

The type of waste, the source of the waste, the waste management method, the quantity of the waste, and the annual waste management cost for each waste stream identified are given in Table 1.

Table 2 shows the opportunities for waste minimization that the WMAC team recommended for the plant. The minimization opportunity, the type of waste, the possible waste reduction and associated savings, and the implementation cost along with the simple payback time are given in the table. The quantities of waste currently generated by the plant and possible waste reduction depend on the production level of the plant. All values should be considered in that context.

It should be noted that the financial savings of the minimization opportunities result from the need for less raw material and from reduced present and future costs associated with waste management. Other savings not quantifiable by this study include a wide variety of possible future costs related to changing emissions standards, liability, and employee health. It also should be noted that the savings given for each opportunity reflect the savings achievable when implementing each waste

Table 1. *Summary of Current Waste Generation*

Waste Generated	Source of Waste	Waste Management Method	Annual Quantity Generated (lb)	Annual Waste Management Cost[1]
Spills and leaks	Various processes including batching and mixing	Harden onto floor	6,320	$3,160
Contaminated solvents	Various processes including lacquer production and letdown	Shipped offsite	325,950	187,540
Evaporated solvents	Pre-batch and mixing	Evaporates to plant air	25,300	12,130
Off-specification paint	Letdown	Air dried; landfilled	2,200	4,215
Latex sludge	Tank cleaning	Shipped offsite	208,330	22,780
Solvent-based paint sludge	Tank cleaning	Shipped offsite	17,520	4,200
Reclaimed solvents	Various processes including lacquer production and letdown	Reused in process	180,000	2,150
Raw material storage bags	Pre-batch	Landfilled	49,000	430
Spent filter cartridges	Filtration and filling	Air-dried; landfilled	18,000	320
Raw material drums	Pre-batch	Reused in process	12,000	320

[1] Includes waste treatment, disposal, and handling costs, and applicable raw material costs.

Table 2. *Summary of Recommended Waste Minimization Opportunities*

Minimization Opportunity	Waste Stream Reduced	Annual Waste Reduction		Net Annual Savings	Implementation Cost	Simple Payback (yr)
		Quantity (lb)	Percent			
Implement a computer-based system for batch scheduling, inventory, and waste documentation to reduce waste generation.	Spills and leaks Contaminated solvents Evaporated solvents Latex sludge Solvent-based paint sludge	3,162 162,960 12,649 104,160 8,760	50 50 50 50 50	$114,000	$60,000	0.5
Cover portable tanks whenever possible to eliminate solvent evaporation.	Evaporated solvents	20,240	80	9,700	16,600	1.7
Extend the time for settling and decanting. Air-dry sludge in outdoor pools. Install a direct-heat countercurrent rotary dryer to reduce the volume of latex sludge hauled offsite.	Latex sludge	124,160	60	6,450	12,000	1.6
Prevent drying of residual paint in portable tanks to reduce the need for caustic washing.	Solvent-based paint sludge	5,840	33	960	0	Immediate

minimization opportunity independently and do not reflect duplication of savings that would result when the opportunities are implemented in a package.

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